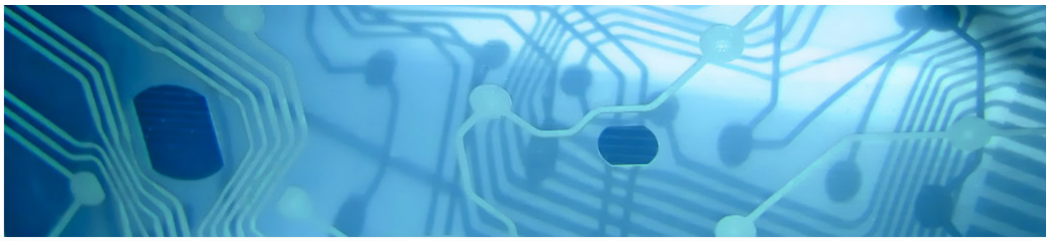

CSEV

Learning by numbers

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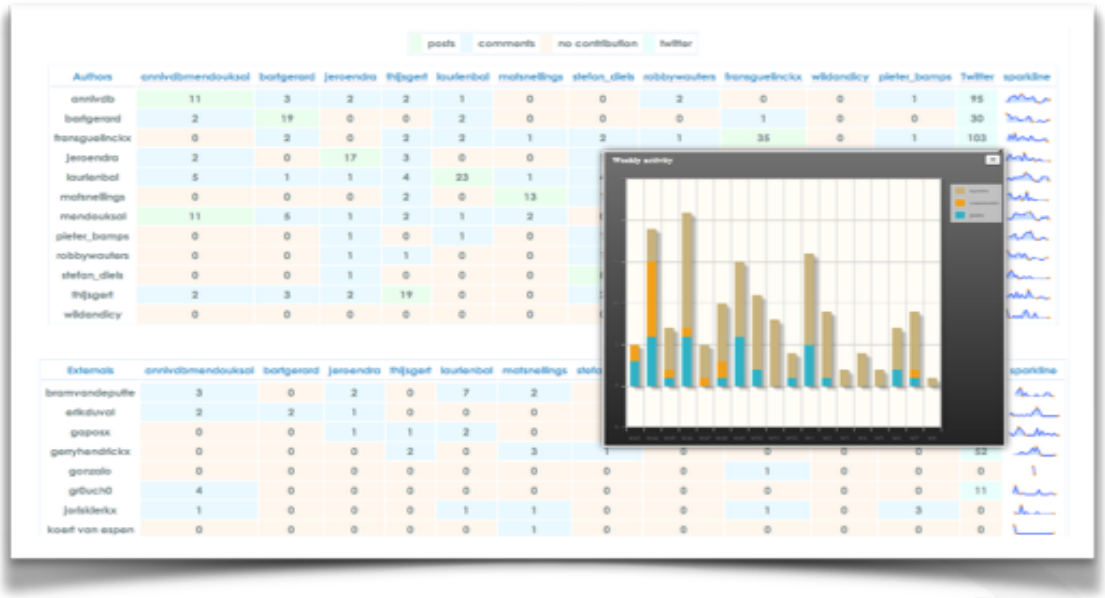
According to the NMC Higher Education Horizon Report of 2014, learning analytics is on a time-to-adoption horizon of 'one year or less'[1]. Recent announcements by companies such as Blackboard, Canvas, Moodle, Knewton, … illustrate that learning analytics tools are arriving on the market. Funding agencies like the EU FP7 and the NSF have funded R&D projects on learning analytics. Since 2011, there is a yearly LAK conference on 'Learning Analytics and Knowledge'[2], organised by a Society for Learning Analytics Research[3]. In short, there is quite a bit of interest and the expectation is that learning analytics will enter the mainstream of widespread adoption in the coming few years.

But what is learning analytics? My favourite definition is '*Learning Analytics is about collecting traces that learners leave behind and using those traces to improve learning*'. This definition is deliberately vague (or shall we say open) about what kind of traces are collected, how and how these traces are used to improve learning. But the goal is clear: 'to improve learning'.

Learning traces can be gathered in the digital world: as learning moves on-line, we can collect many more such traces. Virtual Learning Environments (VLE's) or Learning Management Systems (LMS's) like Blackboard, Canvas and Moodle already collect every click or text entry in the log files. This makes it possible to detect which learner or teacher has posted a message, downloaded a document, asked a question in a chat session, commented on a document, answered a question, submitted an assignment, chatted about a course session, voted in a lecture response system, etc.

However, it is important to note that, in most cases, much of the relevant student and teacher actions happened outside of the 'official' learning environment: students set up Facebook groups to discuss class assignments, chat about relevant documents over an instant messaging application, etc. This kind of activity can also be tracked - in fact, it often is by the likes of Facebook, Google Analytics, etc. More interestingly, we can also add those traces to the learning analytics set, by leveraging social media analytics[4], or web analytics (for instance the edit trail in a wiki) or even personal analytics of all activity tracked in a personal desktop[5]…



More opportunities arise from the fact that more and more analogue, physical activities can also be tracked. This is at the core of a movement called Quantified Self, for 'self knowledge through numbers'[6]. Early commercial successes in this realm often focus on health related fitness applications like fitbit[7], Nike plus[8] and many others: they typically rely on a small sensor that the user wears in a shoe, wristband or similar.

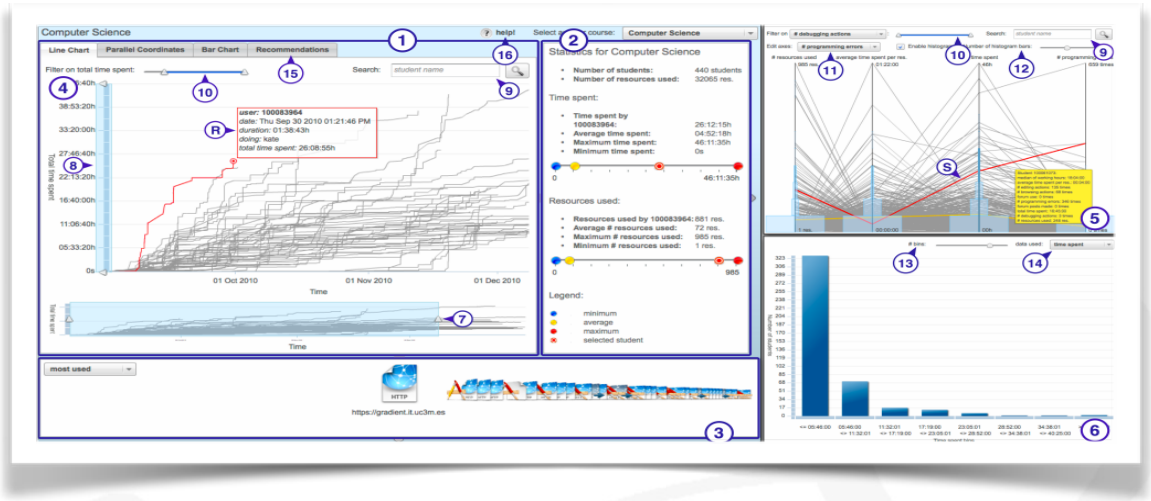
The sensor collects data from the physical world and typically interacts with a mobile computing device like a smartphone. From there, the data are sent to a central repository, so that users can follow their activities, translate them into calories burned, match them against a training profile, analyse their sleeping patterns, etc. Other applications rely on manual input to for instance track emotions[9], or how well users satisfy self imposed goals[10], etc.

There are obvious ways to use this kind of Quantified Self applications for learning: indeed, we have recently been experimenting with emotion tracking with our students (and within our research unit!), students have been building their own applications with raspberry pi and arduino technology[11] in a participatory design approach, etc. Moreover, there are early examples that are specifically geared towards learning, like the table with embedded microphones at EPFL that tracks conversation between students working together on an assignment[12].

However, even if it is often claimed that 'data is the new oil', data is just … data. In order to derive value and meaning from data, we typically have two different approaches:

1. In *educational data mining*, the data is processed by algorithms in order to detect patterns in the interactions and activities of learners and teachers[13]: typically, learners are directed towards activities that 'other learners like them' have carried out successfully before and away from activities that such learners have done without success.

2. In *information visualisation* approaches, we typically refer the sense making to the learners and teachers by presenting them the learning analytics data in ways that they can understand and act on. A particularly relevant approach in this context is that of learning dashboards[14] - like Figure 1 above or Figure 2 below - the idea is that such applications enable students or teachers to make more informed decisions about how they organise their own learning or that of their students, so that their activities can be more effective or efficient.



As wearable and ubiquitous computing evolves, the opportunities for tracking and displaying the tracked information become more and more interesting: for instance, we have experimented with public displays of the tracked data that trigger conversations among students or between students and teaching staff about their activities.

It is obvious that this kind of tracking requires some form of trust and privacy handling. In our own work, we have always followed a principle of *transparency*, at different levels:

- First of all, students know that they are being tracked.
- Students have access to all the data that is tracked about them: this is also useful because it enables them to provide feedback if something is not tracked correctly due to technical problems.
- In fact, all students have access to all the data that we have access to, so that there can be no misunderstanding of what is being tracked.

- We often track the same data about ourselves that we track about our students and share those data back with the students - this has turned out to be a really good way of ensuring that our decisions stay compatible with our own values.
- Because this is such a tricky area, we actually make all tracking data available in a public way, in order to encourage a healthy debate about what can be tracked and how the tracked data can be processed.
- In any case, we believe that this general principle of transparency is important - whether everybody should always make all tracked data public to everyone may be a different matter.

In practical terms, readers who would like to get started practically with learning analytics could approach their efforts from two angles:

1. In a demand led way, one could ask what one would like to know about how students are doing and then try to figure out ways of obtaining the necessary data, either by manual input or through automated tracking.
2. In a supply driven way, one could analyse what opportunities for tracking and reporting exist and how the data involved can be leveraged for improving learning.

From whatever angle one starts, and although there is a certain risk that we will focus too much on things that can be measured rather than on things that matter, we do believe that learning analytics offers many opportunities for data driven innovation…

References

[1]NMC Horizon Report 2014 Higher Education Preview, see http://www.nmc.org/pdf/2014-horizon-he-preview.pdf

[2]See http://lakconference.org

[3]See http://www.solaresearch.org

[4]See for instance http://www.wolframalpha.com/facebook/

[5]See for instance https://www.rescuetime.com

[6]See http://quantifiedself.com

[7]See http://www.fitbit.com/

[8]See http://nikeplus.nike.com/

[9]See for instance http://moodpanda.com/features.aspx

[10]See for instance http://lift.do

[11]See http://arduino.cc and http://www.raspberrypi.org

[12]See Khaled Bachour, K.; Kaplan, F. and P. Dillenbourg (2010): "An Interactive Table for Supporting Participation Balance in Face-to-Face Collaborative Learning," *IEEE Transactions on Learning Technologies, vol. 3, no. 3, pp. 203-213*, July-September, 2010.

[13]See http://www.educationaldatamining.org

[14]See K. Verbert, K.; Duval, E.; Klerkx, J.; Govaerts, S. and J. L. Santos (2013): "Learning analytics dashboard applications", *American Behavioral Scientist, 57(10):* 1500–1509, and Verbert, K.; Govaerts, S.; Duval, E.; Santos, J.; Assche, F.; Parra, G. and J. Klerkx: "Learning dashboards: an overview and future research opportunities", *Personal and Ubiquitous Computing*, In press.